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**From:** Ohl, Matthew [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=5BDE479F1AB54A9EBC9541A7D452C3B7-MOHL]  
**Sent:** 5/28/2020 8:25:59 PM  
**To:** Suzanne OHara [SOHara@Geosyntec.com]  
**CC:** pracher@psrb.com; Douglas Petroff [DPetroff@idem.in.gov]; Mark Nichter [Mark.W.Nichter@usace.army.mil]; Krueger, Thomas [krueger.thomas@epa.gov]; Douglas Buchanan [Douglas.M.Buchanan@usace.army.mil]; Becker, David J CIV USARMY CEHNC (US) [Dave.J.Becker@usace.army.mil]; Andrew A Gremos [agremos@ramboll.com]; Christopher Gale [CGale@Geosyntec.com]; Gary Wealthall [GWealthall@Geosyntec.com]; Mark Harkness [Mark.Harkness@ramboll.com]; Norman Bernstein [nwbernstein@nwblc.com]  
**Subject:** RE: Third Site - DNAPL Containment Area Sampling Plan - Phase 2

Suzanne:

USACE contacted TRS to address the azeotrope of 1,2-dichlorobenzene (1,2-DCB). TRS informed USACE that a more accurate estimate is 97.6 C for 1,2-DCB, and 97.3 C for 1,4-DCB at ambient pressure. Assuming a containment area depth of 40 feet and a depth to water of 10 feet, the 30 feet of head would represent about 13 psi or about 0.88 atmospheres. To boil, the combined vapor pressures may need to reach almost 1.9 atmospheres. USACE believes the temperatures may have to be somewhat higher than 100 deg C to overcome this, perhaps up to about 115 deg C, based on vapor pressure vs. temperature curves for water.

It would be helpful to complete our review, if you could provide drawings showing the distribution of any constituents/azeotrope with an effective boiling point (considering the head pressure) above 100 degrees Centigrade across the Third Site monitoring well network and within the DNAPL area.

Thank you,

Matt

Matthew J. Ohl  
Remedial Project Manager  
United States Environmental Protection Agency  
77 West Jackson Boulevard, SR-6J  
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**From:** Suzanne OHara <SOHara@Geosyntec.com>  
**Sent:** Friday, May 22, 2020 1:16 PM  
**To:** Ohl, Matthew <ohl.matthew@epa.gov>  
**Cc:** pracher@psrb.com; Douglas Petroff <DPetroff@idem.in.gov>; Mark Nichter <Mark.W.Nichter@usace.army.mil>; Krueger, Thomas <krueger.thomas@epa.gov>; Douglas Buchanan <Douglas.M.Buchanan@usace.army.mil>; Becker, David J CIV USARMY CEHNC (US) <Dave.J.Becker@usace.army.mil>; Andrew A Gremos <agremos@ramboll.com>; Christopher Gale <CGale@Geosyntec.com>; Gary Wealthall <GWealthall@Geosyntec.com>; Mark Harkness <Mark.Harkness@ramboll.com>; Norman Bernstein <nwbernstein@nwblc.com>  
**Subject:** RE: Third Site - DNAPL Containment Area Sampling Plan - Phase 2

Matt

You have requested a set of figures showing the distribution of compounds in groundwater at the Site that have boiling points above 100 °C. However, these compounds are no longer the pure chemical and are mixed with groundwater in the subsurface. The heterogeneous azeotrope is the temperature at which compounds mixed with water will begin to co-boil. As a result of Raoult's Law, the vapor pressures of the two components are additive, such that they co-boil at a temperature below the boiling points of each of the pure substances. Once the temperature has risen past the heterogeneous azeotrope, DNAPL can no longer exist as a separate phase. The attached table presents the heterogeneous azeotropes of the compounds detected in the groundwater at the Third Site. As can be seen from the table, azeotropes for VOCs at the site are all below 100 °C.

Based on the azeotrope analysis there are no compounds in the sheet pile enclosed DNAPL area with a co-boiling point above 100 °C.

Regards,

Suzanne

**Suzanne O'Hara. MSc., P.Geo. (ON), P.G. (NY)**

Principal Hydrogeologist

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**From:** Norman Bernstein <[nwbernstein@nwblc.com](mailto:nwbernstein@nwblc.com)>

**Sent:** Thursday, May 21, 2020 3:06 PM

**To:** Ohl, Matthew <[ohl.matthew@epa.gov](mailto:ohl.matthew@epa.gov)>

**Cc:** Suzanne OHara <[SOHara@Geosyntec.com](mailto:SOHara@Geosyntec.com)>; [pracher@psrb.com](mailto:pracher@psrb.com); Douglas Petroff <[DPetroff@idem.in.gov](mailto:DPetroff@idem.in.gov)>; Mark Nichter <[Mark.W.Nichter@usace.army.mil](mailto:Mark.W.Nichter@usace.army.mil)>; Krueger, Thomas <[krueger.thomas@epa.gov](mailto:krueger.thomas@epa.gov)>; Mary Desmond <[mdesmond@nwblc.com](mailto:mdesmond@nwblc.com)>; Douglas Buchanan <[Douglas.M.Buchanan@usace.army.mil](mailto:Douglas.M.Buchanan@usace.army.mil)>; Becker, David J CIV USARMY CEHNC (US) <[Dave.J.Becker@usace.army.mil](mailto:Dave.J.Becker@usace.army.mil)>; Andrew A Gremos <[agremos@ramboll.com](mailto:agremos@ramboll.com)>; Christopher Gale <[CGale@Geosyntec.com](mailto:CGale@Geosyntec.com)>; Gary Wealthall <[GWealthall@Geosyntec.com](mailto:GWealthall@Geosyntec.com)>

**Subject:** Re: Third Site - DNAPL Containment Area Sampling Plan - Phase 2

Matt

Suzanne has not been available to respond to your email of yesterday. We will supply the information requested.

Norm

On Wed, May 20, 2020 at 8:53 AM Ohl, Matthew <[ohl.matthew@epa.gov](mailto:ohl.matthew@epa.gov)> wrote:

Suzanne:

Thank you for the sampling plan for phase 2. To assist in our review, please provide drawings showing the distribution of any constituents with a boiling point above 100 degrees Centigrade across the Third Site monitoring well network and within the DNAPL area.

Thank you,

Matt

Matthew J. Ohl  
Remedial Project Manager  
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**From:** Suzanne OHara <[SOHara@Geosyntec.com](mailto:SOHara@Geosyntec.com)>  
**Sent:** Friday, May 15, 2020 4:29 PM  
**To:** Ohl, Matthew <[ohl.matthew@epa.gov](mailto:ohl.matthew@epa.gov)>  
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**Subject:** Third Site - DNAPL Containment Area Sampling Plan - Phase 2

Matt

Please find attached the Phase II DNAP Area Supplemental Sampling Plan which presents the results of the groundwater sampling conducted in Phase I and the plan for Phase II with the proposed soil and deep groundwater sampling locations.

Please let us know if you have any questions or comments on the attached.

Regards,

Suzanne

**Suzanne O'Hara. MSc., P.Geo. (ON), P.G. (NY)**

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